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PADI CULTIVATION IN SIAM.

By E. Bateson.

The following notes give a brief description of padi-growing in Siam, to which country a visit was paid in June of the present year. Efforts are being made by the Agricultural Department to improve the methods of padi cultivation in the F. M. S., and while much information will doubtless be obtained from the experiments which are being conducted in Krian, it is important that the fullest use should be made of experience gained in other padi-growing countries. It is also desirable to improve the quality of the padi grown in this country by introducing seed of better varieties from abroad, and since Siamese rice is sold extensively in Malaya, and commands, in virtue of its superior quality, a higher price than rice which has been locally grown, it suggests itself as one of the first the introduction of which should be attempted.

Padi is the chief and almost the only agricultural product of Siam, and all classes of the people, from the royal family downwards, engage either directly or indirectly in its cultivation. For the most part the implements used are the primitive ones which have been employed by the Siamese for centuries, and the methods of cultivation are the same as have been practised in the country from time immemorial. More up-to-date methods are now being adopted, owing chiefly to the enterprise of professional men who have received a scientific education in Europe or America, and who follow the national industry as a profitable hobby. Their work in the direction of improved cultivation is all the more valuable because they have collected together the stores of knowledge of padi and padi-growing which have been accumulated by the Siamese, and their scientific training enables them to estimate facts and theories at their proper worth.

Soil and Water Conditions.

The great rice-producing area of Siam is the rich alluvial plain, over six thousand square miles in extent, in the lower part of the Menam valley. Where not cultivated the plain is mostly covered with tall grasses. Extensive forests do not exist, and unopened tracts of country therefore present a striking difference from virgin land in Malaya. The soil in the southern part of the plain is an almost pure clay; further up the valley the clay is mixed with sand, and in the north sand is the predominating constituent. For padi-growing clay soils are found to be more suitable than sandy soils; not only are bigger crops obtained from the former, but also the quality of the grain is said to be better.

As yet the Siamese Government has made no irrigation works, and year by year the people are dependent upon natural supplies for water in which to grow their padi. The rain is brought by the south-west monsoon. That which falls in the plain does little more than soak the soil, but in the mountainous northern provinces the rainfall is very heavy, and the rivers, which have their source there, gradually rise, and after a few weeks become so swollen that on reaching the plain they overflow their banks and convert the whole country into a gigantic sheet of water. The plain is so flat, having an average slope of only one in nine thousand, that the water runs off very slowly. The floods commence as a rule in August, attain their greatest height in October, and subside during November.

In favourable seasons the water rises to a height of a metre, and in some places it reaches more than twice that height. Authorities in Siam consider that the depth of water most suitable for padi is about half a metre. More than this is not necessary, and if there is much less the padi suffers. For good growth it is essential that the roots should be kept cool. If there are only three or four inches of water it becomes heated all through and the heat is passed on to the soil, whereas with a depth of half a metre the uppermost few inches only attain a high temperature, and a layer of cool water is always interposed between this and the ground.

Methods of Cultivation.

As soon as the rainy season has set in and the soil has become wet the Siamese padi-planter begins to plough his fields. He uses a plough of primitive design, made entirely of wood, with the exception that occasionally it has a small iron share. With this implement it is not possible to plough dry soil, or at any rate to do more than scratch the surface, and wet soil is not ploughed to a greater depth than three or four inches. Ploughing is done twice, and often three times, and then the land is harrowed until all the

weeds have been killed. The Siamese harrow, like that used by the Malays, has the appearance of a big rake. The animal used most commonly for ploughing and harrowing is the water buffalo, but on sandy soils bullocks are found to be better.

Systems of Planting.

Both the common methods of padi-planting are practised in Siam; in some districts broadcast sowing is the rule, and in others all the natives transplant their padi. In the former case the seed is sown after the second ploughing, and the land is immediately ploughed a third time and then harrowed, without waiting for more water than will wet the soil. The land is therefore not puddled.

The system of transplanting does not differ greatly from that of the natives of Krian. The seed is sown in a small nursery which has been well ploughed and harrowed, and fifteen days after germination, when the seedlings are about half a metre high, they are pulled up, tied into bundles, and carried into the padi field. Here the tops of the leaves are torn off and the seedlings are planted out in bunches of five, being pushed into the ground with the fingers and thumb. The average distance of the bunches from one another is a foot. The work of transplanting is done by men as well as women. The chief point of difference between the Siamese and the Malay method is that in the latter the seedlings are taken from the original nursery and planted in a second and larger one, from which after about six weeks they are transplanted all over the field. The seedlings are therefore transplanted twice, whereas by the Siamese method they are transplanted once only.

All the operations of sowing or transplanting, whichever is carried out, must be finished by the time the floods begin to come down from the north, and the padi having then established its roots is able to keep pace in its growth with the rising waters.

Harvesting and Yields.

According to the varieties sown, the padi ripens in four, five and a half, or six and a half months. The water generally disappears by the time the padi is ripe, but the earlier varieties are sometimes ready for cutting before the floods subside, and have to be reaped from boats.

The padi is reaped with a sickle, and about a yard of straw is cut with the ears. It is made into bundles and brought to the house on a bamboo sledge drawn by a buffalo, and after being kept for three days the sheaves are spread on a spot where the earth has been beaten down hard and smooth, and are trampled upon by buffaloes until the grain is all detached from the straw. The padi is winnowed by being thrown up into the air from a wooden spade.

The highest individual yield heard of was 600 *gantangs* (gallons) an acre, and the lowest 200 *gantangs* an acre. The yield from seed sown in nurseries and afterwards transplanted is higher than from seed sown broadcast, the proportion being approximately five to three. The average yield from transplanted padi is about 400 or 450 *gantangs* an acre, and from broadcast padi 240 to 270 *gantangs*. The method of broadcasting involves an extravagant use of seed, the amount required being twenty or even thirty *gantangs* per acre compared with five *gantangs* when the padi is transplanted. In Krian, where the seedlings are transplanted twice, three *gantangs* an acre are found to be ample.

(*To be continued.*)

DISEASES OF THE ANGSANA TREE (Pterocarpus indicus.)

By Keith Bancroft.

The Angsana tree, or " Pokok Sĕna " as it is termed by Malays, is a native of the Moluccas. The full-grown tree attains a great height. It has been extensively used in the Malay Peninsula for avenues or roads and has been considered one of the finest of all shade trees, making but little litter from the falling leaves and being strong and seldom breaking. It is particularly suited for roads near the sea. The avenue of Sĕna trees in the Connaught Drive, Singapore, the age of which according to Mr. Derry is about 22 years, is an example of the excellent qualities of the tree. Older specimens of the tree exist in Malacca, Kuala Selangor and Penang.

The tree can be grown from seed but it has been customary to propagate repeatedly from cuttings made from old wood of $\frac{3}{4}$ or more of an inch in thickness and a few feet long.

As cultivated in the Malay Peninsula the tree is liable to a disease resulting in its death. Previous records show that in Malacca between thirty and forty years ago what is described as a magnificent avenue of Sĕna trees was affected by some disease which killed almost all of them. From then until 1906 there appears to be no record of a similar occurrence. In 1906 and during the four subsequent years nearly one hundred trees died in Penang. In December 1910 the death of numbers of Sĕna trees was recorded in the town of Tapah (Perak). More recently, during the present year, many of the trees have died in Kuala Kubu and Kuala Lumpur (Selangor) and in Taiping (Perak). The age of the trees so affected ranges from about ten to forty years.

The symptoms of this disease are in all cases almost similar. The branches and leaves wither and death follows rapidly, being complete usually within two or three months after the trees commence to show signs of being affected. The first observable symp-

tom is the withering and death of young branches bearing leaves and fruits. Single branches may in some few cases show this effect but usually several dead branches appear simultaneously. The death of these branches is followed by the dying of the remaining shoots and the complete death of the tree. Sometimes an attempt at recovery is made, the tree sending up shoots from near the base.

An examination of the dead and dying shoots does not reveal the presence of any organisms to which death can be attributed. The nature of the symptoms suggests some trouble affecting the roots of the tree. When roots in different stages of disease were examined it was found that death of the outer bark and cambium occurred first and was followed in later stages by the disintegration of the wood. The death of the roots was particularly obvious near the collars of dying trees.

The white mycelium of fungi could be observed in many cases on the outside of the bark and between the bark and wood of the dead and dying roots. The mycelium which was most commonly found was frequently aggregated in patches and seldom appeared as strands; where the latter occurred they only travelled for a short distance. In one case I obtained the mycelium on five out of six trees whose roots were examined at Kuala Kubu. On examination this mycelium showed what are known as "clamp-connexions" by which the fungus can be identified as belonging to the group in which are classed the higher forms, viz. toadstools and "bracket" forms of fructifications (Basidiomycetes).

Recently dead roots of a tree which bore the mycelium were transferred to earth in a box and were kept half buried. They developed the "bracket" fructification of a species of *Polystictus*. The fungus is present in this country commonly on dead logs and posts and can be collected freely from stumps of dead Angsana trees. Another fungus producing small fan-shaped brackets, *Schizophyllum commune,* occurs freely on the dead stumps; but it is recognised as a saprophyte.

Fungi collected by Mr. Fox, Superintendent Forests and Gardens, Penang, from dead Angsana Trees in January 1910 were sent to Kew and identified as *Polystictus occidentalis, Polystictus floridanus* and *Schizophyllum commune.* Of these the first named species has been recorded previously as a parasite. Whether this is identical with the bracket form so common on dead Angsana trees in the F. M. S. remains to be determined.

The repeated association of the fungus with dying and dead Angsana trees in the F. M. S. suggests that it may be the cause of the disease. The fungus is very abundant in the F. M. S. and is apparently easily distributed by spores. It would appear, however, on further consideration that there is a factor in the culti-

vation of Angsana as an avenue tree which tends to render it liable to attack from fungus organisms and that is the repeated vegetative propagation from cuttings. The plant grows readily from seed as well as cuttings, and the only advantage to be gained from planting the latter is the more rapid growth which is obtained at first. Repeated propagation from cuttings tends to lead to deterioration in plants and the Angsana trees in the F. M. S. show in many cases a poor growth, scanty foliage, etc. It is probable that repeated propagation from cuttings, by producing weakened plants whose period of life is short, causes a predisposition to disease from fungi. The rapid growth and fine condition of trees in the Connaught Drive in Singapore is attributed by Mr. Derry to made up earth which was deposited there following on the reclamation of the sea front.

It is advisable that future planting of Angsana should be carried out from seed either obtained from healthy old trees in this country or imported.

With regard to the treatment of the disease after it has appeared, the removal of dead roots, and the flooding of the trees by a solution of nitrate of potash (1 lb. in 3 gal. of water) applied in a trench at the base of the tree which has been suggested by Mr. Massee, would be advisable; but as Mr. Massee points out it would probably only delay the end.

It is necessary to remove the dead stumps and in supplying to place the "supplies" between the previously existing Angsana trees.

A leaf disease of the Angsana tree has recently been recorded in Kuala Lumpur and is considered to be due to a fungus, named *Dothidella Pterocarpi,* Massee. So far it only occurs in small quantity. Yellow patches appear on the leaves and become later dry and brown. The whole of the leaflet may be affected, or the disease may occur in patches which sometimes fall out leaving holes.

Angsana is a deciduous tree, shedding its leaves before it flowers. It is, therefore, evident that to wait until the leaves had fallen and to burn them would probably be very serviceable in checking the spread of the disease, should it tend to increase in quantity. This coupled with the application of a fungicide to the young leaves should yield good results.

The fungus is not known to occur on any other plant.

A note on some shade trees which are commonly in use in this country might be serviceable in this connexion. The essentials of a shade tree are that it should produce little litter from the falling leaves, i.e. the leaves should be fairly permanent and preferably small, that it should be a fairly fast grower but at the same time

the wood should not be brittle. Fruit trees should not be employed. The following trees are used:—

Rain Tree, Saman, *Pithecolobium saman;* a rapid grower, grown from seeds or cuttings, making a very serviceable shade tree. The branches must, however, be pruned as it tends to grow out of the desirable shape.

Tamarind, *Tamarindus indicus;* grown from seed, possesses a hard wood, frequently makes a very good shade tree. The fruits, are, however, a drawback to its use along roadsides.

Tembusu, *Fragraea fragrans;* raised from seed, one of our hardest timbers and possesses a very good resistance to wind. It requires pruning as it produces branches low down on the stem. It is perhaps better suited for lawns, being a very handsome tree.

Ketapang, *Terminalia catappa;* produces a large quantity of litter, but is otherwise a serviceable tree.

Flamboyant, *Poinciana regia;* is frequently grown for its beautiful flowers. It is a rapid grower, but is not of long duration; grown from seed.

Cassia Siamea, produces quantities of golden yellow flowers; grown from seed.

Spathodea campanulata, is grown from cuttings. It produces bright red flowers; it is more useful as an ornamental than a shade tree, as it gives but little shade.

Jacaranda mimosaefolia, is well known for its pretty feathery foliage and violet flowers. It is only a small tree and like *Spathodea* is better used for ornamental purposes or for planting between other trees in avenues.

Ru, *Casuarina equisetifolia,* is commonly grown by the roadside but it produces little shade and tends to cast its branches. It is grown from seed and is of rapid growth.

Albizzia moluccana, grows rapidly and can be raised from seed or cuttings. It has been long in use as a shade tree in plantations. It is very large tree.

COCONUT BEETLES.

By L. C. Brown.

The enormous destruction that the two beetles known as the *Red Beetle* (Rynchopherus ferrugineus) and the *Black Beetle* (Oryctes rhinoceros) do, unless the pests are kept well under control is difficult to imagine and it is to the habit of these beetles and the best methods of destroying them and reducing their power of doing serious damage I now propose to enter upon.

Red Beetle: This insect after it is fully developed does no harm to the tree. It generally lays its eggs at the base of the

branches covering the cabbage and so well are they secreted or hidden away that the harm being done is often not detected until it is too late to save the tree. The grub does the havoc, and soon after it is hatched commences its operations by gnawing and boring its way inwards until it reaches the very heart of the cabbage. The work is so rapid and the effect so deadly that these grubs are, in my opinion, very much more dangerous to the life of the tree than the black beetles, but fortunately the red beetle is scarcer. It occasionally takes advantage of the borings made by the black beetles to lay its eggs in these cavities, only here it is more easily discovered in searches for the black beetle, so that with proper supervision it may or should be caught before any serious harm has been done. Apart from these haunts my experience is that there are many other breeding places, a few will be found in manure on rubbish heaps, more again in the rotten dead stumps and roots of sago and serdang palms, and most numerous in a coconut tree from which the top has fallen away through their ravages or a decayed stump of the same tree. Here the grub will be found covered in a cocoon made of the fibre and so well does it conceal itself in this way that it is practically not noticeable to the ordinary view and is only discovered when the inside of the tree or stump is scooped out which I need scarcely say must be done very effectually otherwise one or two of the cocoons may escape observation.

Black Beetles:—It is on account of their great numbers that these beetles are so much to be feared, and the fact that their borings, as I have stated previously, afford a means for inroad by the dangerous red beetle. There absolutely seems to be no limit to the beetles and their grubs, provided the breeding places are sufficiently abundant; and these comprise not only those mentioned in connection with the red beetle but a great many more, such as underneath and in dead palms of several kinds, sawdust, paddy straw, coconut, coffee and paddy husks and refuse heaps of all descriptions. The grubs especially may be found in thousands in quite a small dung heap. When the beetles reach maturity they leave their breeding grounds and it is then they make for the coconut trees and commence their ravages slightly above and near the top of the cabbage, boring their way downwards and laying their eggs at the end of the cavities so formed. Owing to their constant and continual onslaughts they do great damage to the trees, nipping as it were the leaves and the stem that bears the fruit just at the time they are forming; the leaves in consequence afterwards present a jagged or frayed appearance and what is more serious the stem often is killed and if it does shoot out probably bears little or no fruit. There is difficulty in ascertaining how far the beetle can travel in one stage of its journeyings which it makes

at night, but I should say no great distance and about a mile would, I think, be an extreme limit. However it manages to fly to plantations considerable distances away from one another and this may be accounted for by its finding several haunts intervening to avail itself of during its flight.

Remedial and preventive measures. When the beetles appear it is evident there must be some breeding grounds about. The first thing to do is to search out and destroy all the haunts such as have been described and everything that is likely to harbour the pests should be burnt. Attention must also be given to the trees themselves and with regard to this in the first stage then beetles will often be found on the leaves themselves and easily collected. If however the beetle has already found its way into or near the cabbage of the palm, it should be immediately dealt with. For this purpose a stiff bit of wire about 18 inches long with a barb at the end is progged into the hole and thus answers very well for collecting the beetle or beetles that they may be in the trees. These insects must of course be at once destroyed. As soon as the beetles have been extracted from the holes, these should be filled up with a mixture of Zotal and dry sand in the proportion of half a glassful of Zotal to ¼ of a gantang of sand. Even if no beetle is found in the holes the same treatment should be followed as it effectively prevents any other beetles making use of the same haunt. Again, and this is most important, fine sand should be applied copiously to the cavities at the junction with the trunk as this makes it very difficult for the beetle to make any fresh inlet to the tree.

General. While the plantation is young or if there are a great number of trees not in bearing, it will of course be necessary to keep some coolies to look after and give special attention to the beetles; but when all the trees are in full bearing or nominally so and the plantation has been previously well maintained it may be possible to keep away any real harm from attack by beetle, merely by employing the coconut collectors while collecting the nuts, generally every two months, to extract the beetles from the tree. This is the common practice in Penang and other places I know of, the collector usually receiving a cent for every beetle he catches.

NOTES ON TAPPING EXPERIMENTS AT GUNONG ANGSI.

By F. G. Spring.

In April 1905, eight plots of Para Rubber, at different elevations, were opened up on Gunong Angsi for the purpose of attempting to test the effect of climate conditions on the growth of the tree and afterwards the yield of rubber at different altitudes.

The fields are arranged as follows:—plots 1, 2, 3, 4, 5, 6, 7 and 8 at elevations of 300; 600; 1,000; 1,200; 1,600; 1,800; 2,100 and 2,400 feet respectively. In December 1911, the average girth of the trees in each plot, with the exception of field 4 which remains unplanted, was taken at a distance of 3 ft. from the base of the tree and the girths in the respective plots found to be as follows 25·07; 16·29; 21·83; not planted; 17·86; 16·89; 12·09 and 14·21 inches.

Although the trees in field (2) have not grown well, due in all probability to the poor condition of the soil, the figures tend to show that the higher the elevation the slower the growth of the trees. During the past year the trees in plots 7 and 8 do not appear to have increased in girth.

In August 1911, the trees in fields 1 and 3 were marked out as specified in the tables and tapping commenced on the 27th of that month. For the purpose of comparison the experiments in fields 1 and 3 are the same. It is intended to conduct similar experiments in the other plots but as the majority of the trees were not of sufficient girth they are to be tapped at a later date. The experiments were under careful supervision both as to the depth of the cut and the quantity of bark removed in a given time, the latter being examined every month and directions issued as to whether the bark removed was in excess or otherwise. In this way it was possible to complete the tapping of the surface in each experiment almost at the same time. The labour employed was Tamil, one coolie being in charge of one experiment, namely 80 trees. The gouge knife was used throughout. Fortunately no trees were lost by disease. The distance of planting is 20 x 20 ft. It will be seen that in experiments 1 and 3 where tapping is conducted every day the whole circumference is completely tapped in 2 years while in experiments 2 and 4, alternate day tapping, the time allowed for bark renewal is 4 years.

In field (1) which is situated at an elevation of 300 feet the yields of total rubber in experiments 1, 2, 3 and 4 are 555 lbs.; 303 lbs.; 441 lbs.; and 237 lbs. a total of 1536 lbs. While in field (3) at an elevation of 1,000 ft. the yields of total rubber in experiments 1, 2, 3, and 4 are 388 lbs.; 207 lbs.; 308 lbs. and 195 lbs. a total of 1,098 lbs. The increase of rubber obtained in the plot at the lower elevation compared with field (3) is 167 lbs.; 96 lbs.; 133 lbs. and 42 lbs. in the respective experiments or a total of 438 lbs. The increase is no doubt connected with the larger girth of the trees in field (1) but indirectly to the trees being at a lower elevation.

To what height Hevea may be grown without a rapid falling off, both in girth and quantity of rubber, is difficult to say but

judging from the present experiments an elevation of 1,000 feet is undoubtedly too high to obtain the maximum yield of rubber.

The next point of interest is the relative yields of rubber from different systems of tapping. It will be seen by referring to the tables that in each experiment, both at the first and third clearings, the adjacent quarters (double V) gave a considerably larger yield of total rubber than the opposite quarters. The total excess of rubber obtained from adjacent quarters compared with opposite, in fields (1) and (3) where two years is allowed for bark renewal, experiments 1 and 3, is approx 25·0 per cent, while in the plots where the period of renewal is 4 years, experiments 2 and 4, the excess is approx 17·0 per cent. Both in adjacent and opposite systems of tapping, where two years is allowed for bark renewal, the amount of total rubber is almost double that obtained from the experiments in which 4 years is allowed for bark renewal, in other words the quantity of latex obtained has been directly dependent on the amount of bark removed.

A notable and interesting feature is that this excess is more evident in the first few months of tapping while at the end of one year the difference is apparently not so great. This falling off of rubber in experiments 1 and 3 is in all probability a sign of exhaustion followed on the severe tapping conducted in these experiments. It will be interesting to see how large the difference becomes as tapping progresses.

The Rubber is sent to Kuala Lumpur Experimental Plantation where a daily record of the wet and dry rubber is kept.

The amounts of Rubber recorded in the tables are their dry weights.

Experiment 1.

System of tapping—Double V, cuts 18 inches apart.
Twenty cuts to the inch. Every day tapping.
Time allowed for bark renewal 2 years.
No. of trees 1st clearing 80, average girth 26·3 inches, elevation 300 ft.
No. of trees 3rd clearing 80, average girth 21·12 inches, elevation 1,000 ft.

Experiment 2.

System of tapping—Double V, cuts 18 inches apart.
Twenty cuts to the inch. Alternate day tapping.
Time allowed for bark renewal, 4 years.

No. of trees 1st clearing 80, average girth 25·6 inches, elevation 300 ft.

No. of trees 3rd clearing 80, average girth 21·4 inches, elevation 1,000 ft.

EXPERIMENT 1. EXPERIMENT 2.

Latex Rubber.					Latex Rubber.				
Month	1st. Clearing		3rd. Clearing		Month	1st. Clearing		3rd. Clearing	
	lbs.	ozs.	lbs.	ozs.		lbs.	ozs.	lbs.	ozs.
27-31 Aug. 1911.	1	2	0	16	27-31 Aug. 1911.	0	9	0	7
September ,,	43	3	17	1	September ,,	16	14	10	11
October ,,	45	13	22	11	October ,,	15	2	10	14
November ,,	47	15	28	13	November ,,	24	14	11	12
December ,,	48	4	21	2	December ,,	29	12	16	12
January 1912.	46	15	28	1	January 1912.	15	11	11	11
February ,,	42	16	31	12	February ,,	20	0	9	6
March ,,	37	10	32	6	March ,,	16	3	10	9
April ,,	34	1	27	1	April ,,	13	15	12	5
May ,,	32	7	34	1	May ,,	25	1	14	4
June ,,	30		33	10	June ,,	23	16	19	2
July ,,	40	1	36	6	July ,,	34	2	27	10
1-26 August ,,	33	15	26	2	1-26 August ,,	29	8	16	13
Total	484	13	340	2	Total	265	11	172	4
Total Scrap & Bark Shaving	70	14	48	12	Total Scrap & Bark Shaving	38	2	35	8
Total Rubber	555	11	388	14	Total Rubber	303	13	207	12

EXPERIMENT 3.

System of tapping—opposite quarters. Two cuts of 18 inches apart on each quarter.

Twenty cuts to the inch. Every day tapping.

Time allowed for bark renewal 2 years.

No of trees 1st clearing 80, average girth 25·1 inches, elevation 300 ft.

No. of trees 3rd clearing 80, average girth 21·9 inches, elevation 1,000 ft.

EXPERIMENT 4.

System of tapping—opposite quarters. Two cuts of 18 inches apart on each qarter.

Twenty cuts to the inch. Alternate day tapping.

Time allowed for bark renewal 4 years.

No. of trees 1st clearing 80, average girth 25·8 inches, elevation 300 ft.

No. of trees 3rd clearing 80, average girth 21·7 inches, elevation 1,000 ft.

EXPERIMENT 3.

Latex Rubber.

Month	1st Clearing		3rd Clearing	
	lbs.	ozs.	lbs.	ozs.
27-31 Aug. 1911.	0	14	0	8
September ,,	20	10	13	2
October ,,	25	14	13	15
November ,,	32	7	21	11
December ,,	47	1	21	9
January 1912.	35	3	21	2
February ,,	29	8	21	7
March ,,	34	2	23	14
April ,,	29	2	20	14
May ,,	27	4	22	9
June ,,	33	2	23	0
July ,,	41	3	35	9
1-26 August ,,	28	4	23	1
Total	384	10	262	5
Total Scrap & Bark Shaving	57	4	46	10
Total Rubber	441	14	308	15

EXPERIMENT 4.

Latex Rubber.

Month	1st Clearing		3rd Clearing	
	lbs.	ozs.	lbs.	ozs
27-31 Aug. 1911.	0	3	0	6
September ,,	6	3	9	6
October ,,	10	6	9	7
November ,,	13	15	11	1
December ,.	18	2	12	14
January ,,	14	5	13	1
February ,,	12	9	12	1
March ,.	14	15	13	0
April ,,	14	6	13	5
May ,,	11	14	8	15
June ,,	21	11	13	0
July ,,	28	10	23	2
1-26 August ,,	20	7	17	14
Total	187	10	162	8
Total Scrap & Bark Shaving	49	10	32	14
Total Rubber	237	4	195	6

	Expt. 1. Elevaiton	Expt. 2. T. Rubber		Expt. 3. T. Rubber		Expt. 4, T. Rubber		Grand Tota	
1st Clearing	300 ft.	lbs. 555	ozs. 11	lbs. 303	oz. 13	lbs. 441	ozs. 14	lbs. 237	ozs. 4	lbs. 1538	ozs. 10
3rd Clearing	1,000 ft.	388	14	207	12	308	15	195	6	1100	15

TANKAWANG FAT (Borneo Tallow).

By M. Barrowcliff.

A writer in the August number of the *Agricultural Bulletin* asked for information regarding Sengkawang or Tengkawang fat, which the following notes, taken mainly from Lewkowitsch's 'Oils,

Fats and Waxes' but partly embodying the results of an examination of a locally obtained specimen, endeavour to supply.

The fat, known commercially as Borneo tallow, is obtained from the kernels of a large variety of plants belonging to the family of *Dipterocarpus* as *Shorea stenoptera* Burck., *Shorea aptera,* Burck., *Hopea aspera,* de Vriese, *Isoptera borneensis,* Scheff., *Pentacme siamensis,* Kurz, etc., indigenous to Indo-China and Malaysia. It represents a mixture of at least six fats, obtained from six varieties of trees, known to the natives of Borneo as *Tangkawang toengkoel, T. rambei, T. lagar* (these trees have a diameter of more than 3 feet), *T. goentjang* (growing in swampy regions and reaching a height of 22 feet whilst the diameter of the trunk rarely exceeds 6 inches), *T. madjan, T. terindak.* The last two trees bear smaller fruits, which yield a fat containing about 3 per cent of unsaponifiable matter, which is apparently a natural rosin inasmuch as it imparts to the fat a viscous character. The first four trees grow wild on the west coast of Borneo, excepting on the strips of land bordering the Kapoea river. The "tengkawang trees" are also cultivated by the natives (chiefly in the districts of Sanggan and Sekadan). The trees flower in September and October, and the fruits ripen in February and March.

The fat is prepared by the Annamites, according to Lemarié, in the following manner:—The hard fruits are left for some time in a damp place until the shells break and the seeds begin to germinate. They are then dried in the sun, the kernels are separated from the pericarp and placed in baskets of bamboo canes, which are suspended over pots of boiling water. When the kernels have become soft and pasty they are placed in bags and pressed. The fat thus obtained is moulded in the internodes of bamboo stems; hence the cylindrical shape of the commercial samples.

In Borneo the fat is obtained either by "wet process" or by a "dry process." The wet process consists in placing the fruits in baskets, which are then completely immersed in water; care being taken that the fruits cannot float to the surface,—this being done to prevent germination.

The immersion in water appears to be a process of preservation; the natives believing that in consequence of it the fruits are not so easily attacked by the "boebuk" worm. After thirty to forty days the fruits are taken out of the water and the shells are removed. The kernels, which are generally split up into four parts, are spread on boards, and exposed to the sun to dry and then pressed out as above.

In the "dry" process the kernels are cut into discs immediately after collecting the fruit, dried by exposure to the sun and the fat expressed as in the previosly described methods. This latter quality

is considered the best and is used exclusively for edible purposes by the natives.

The percentage yield of fat from the fruits does not seem to have been determined, except in the case of *Shorea stenoptera* which afford about 50 per cent.

In commerce varieties of Borneo tallow are known under the names "Pontianak," "Sarawak," and "Siak" tallow. The "Pontianak" and "Sarawak" are obtained from the first four kinds of tangkawang mentioned above, and are notable for their hardness. Of the two kinds "Pontianak" is the more valued. The "Siak" tallow is much softer and hence the less valued.

Borneo tallow has a light green color, changing to yellow, and after prolonged exposure to the air, to white. At the ordinary temperature it resembles cacao butter in consistence.

The following characteristics of various samples are given by Lewkowitsch.

Fast from	Melting Point 0° C	Saponification Value	Iodine Value
Shorea aptera	31	191·2	15
Isoptera borneensis	—	192·2	16
Commercial Samples	35·4	—	31
" "	34·6	194·6	30·1
" "	42-45	193·8	29·4
" "	37·5	194	30-31

A sample in the Agricultural Department, one exhibited at the Agricultural Show 1910 has been found by the writer to give the values:—

Melting Point	Saponification Value	Iodine Value
38·4° C	191·8	24·4

and to contain the glycerides of stearic, palmitic, and oleic acids.

It is almost white in colour and of the degree of consistency of a tallow candle, and is undoubtedly an excellent specimen.

For cultivation purposes it will be necessary to select the tree affording the hardest fat compatible with a good yield. It should prove a valuable material for soap and candle making and has the possibilities of becoming of great commercial importance.

Mr. Bancroft informs me that Ridley quotes *Diploknema sebifera* as a source of the fat. This should, therefore, be added to the above list.

THE RICE CROP IN MALAYA.

By N. W. Barritt.

1. Its decline.

Coincident with the enormous development of the commercial resources of this country there has been a steady decline in the cultivation of padi; a decline which is receiving attention from the Government as seen by the various official reports, by the considerable expenditure on irrigation works and by the recent grant for the investigation of padi cultivation. The cause of this decline is undoubtedly the uncertainty of the harvest and the existence of better employment elsewhere; and it is generally maintained by those who are supposed to know the Malay, that nothing short of compulsion will make him cultivate his bindang. Excellent as this opinion may be in expressing the Malay character, it can hardly be taken as a serious suggestion for the encouragement of this cultivation. Though superstitions and customs die hard, and the Malay still prefers life in a kampong, he entertains no delusions about the charm of following the plough or swinging the changkul. He prefers rather a more reliable source of income than that to be obtained by the cultivation of a precarious crop of rice. And this should cause no surprise, for what farmer worthy of the name, would cultivate his land regardless of the returns at harvest. Much may be said about the healthiness and aesthetic appeal of rural life, but it is only the retired business man who can afford to cultivate the soil from that standpoint alone. Not until the Malay has been assured of a certain profit from padi cultivation and one that compares favourably with that to be derived from other occupations, is it reasonable to expect that he will be induced to show more enthusiasm for the cultivation of his bindang?

2. Improvements.

The chief factors upon which the certainty of a successful harvest depend are—

1. Protection against the wholesale destruction of the crop by rats and wild pigs.
2. An adequate water supply under control.
3. A means of maintaining the fertility of the soil that is not beyond the scope of the Malay.
4. The prevention of loss by insect and fungoid pests.

Of these factors No. 1 demands first attention in some districts, and is obviously a fundamental condition for any system of civilised agriculture. Its success rests entirely with the natives and requires concerted action.

The qestion of water supply, No. 2, has already been taken up by the Government and additional irrigation works are now in course of construction. Whilst of immense importance in itself it cannot be fully appreciated unless factors No. 3 and 4 are taken into account.

Factor No. 3 is now receiving attention in experiments being carried out by Mr. Bateson in Krian and No. 4 will be dealt with to some extent in the experiments on the different varieties of rice now being commenced by the writer of the article.

It is well known that the increase in yield of any crop like any form of profit follows the Law of Diminishing Returns for a given increase of expenditure, and that a limit is soon reached beyond which any further increase in yield ceases to be profitable. This particular limit with respect to factors 2 and 3, for certain native varieties will be determined by the Krian Experiments mentioned above, and it is hoped that the work on the improvement of varieties by selection and hybridisation will extend this limit of profitable increase and at the same time enhance the value of this increase. The improvement of varieties that is being attempted concerns the yield of grain, immunity to disease and quality of grain. A particular variety possessing all these characters well developed may be regarded as ideal but such a variety is never found in nature (except perhaps in the case of certain obnoxious weeds *e.g.* lalang), though we have our 'El Dorados' and 'Ne Plus Ultras' in the Horticultural world.

However, in recent years very successful attempts have been made towards producing such varieties in the case of wheat. The recent work in Mendelism or the science of heredity, has shown that by an analysis of the characters of a particular individual and a study of the inheritance of its unitary characters, it is possible to produce hybrid forms possessing new combinations of these characters that will breed true, and provided one is certain of dealing with Mendelian units of character, which are not mutually exclusive, it is possible to produce any desired combination of characters. The work of Professor Biffen at Cambridge and of Howard at Pusa, in India, has shown that such characters as disease resistance, yield and quality of grain in the wheat plant are Mendelian characters, and they have succeeded in producing hybrid varieties possessing these characters. That these achievements are of more than academic interest is shown by the fact these new varieties are now being appreciated by the farming community both at home and in India. Therefore one can reasonably expect that a similar improvement is possible with rice and that it would be just as valuable to the 'Sawang' as the improvement in wheat is to the farmer.

3. The Question of Quality.

Of the desirable improvements in the varieties of padi, the one that presents the most difficulty is that concerning the quality of the grain. How are we to define quality in rice? This is a question that concerns the physiologist, the miller, and the consumer, and unfortunately all three look at it from different standpoints. The physiologist looks at it from the standpoint of nutrition and its relation to Beri-beri, the miller considers it in relation to his machinery and the appearance of the finished product, whilst the consumer, the native in particular, is influenced by a most fastidious taste. For which *'oikos'* has one to be *'nomikal?"*

In the case of wheat, which presented a very similar situation in the question of food value *v* size of loaf, and terminated in the 'Standard Bread' campaign of last year, the miller is now dominant and he defines the quality of the wheat according to its ability to make a pure white flour and large loaves. Similarly we may expect that the rice miller will set the fashion in the quality of rice, because as civilisation advances conditions are not suitable for the preparation of food at home and a more mixed diet is adopted, thereby supplying any missing link of a protein nature that may have been removed from one particular article of diet in the process of manufacture, and with this increasing commercial preparation of food individual delicacies of taste are swept aside like old traditions, and a standard article becomes general.

Whether this is in the interests of the welfare of the community is another matter but it cannot be denied that this is the general tendency of the times and that attempts to check it by education or otherwise seem to meet with little success.

Thus if the Malay padi-planter is to grow rice that will find a ready sale and a good price in the market he must be prepared to meet the demands of the market with respect to its definition of quality. In the markets of this country, a rice of first quality is one that is long and cylindrical in shape, even in size of grains, possessing strength or resistance to fracture in the milling process and of a translucent colour. Such rices are now imported from Siam and China and they constitute the first quality rice sold in the local k'dais at 55 to 60 cts. per gantang, whilst the native rices with the exception of Padi Radin, well grown in Krian, make up the bulk of the cheaper parboiled and broken rice.

The enormous difference in quality and market value between the different rices is seen from the following quotation of market prices at Penang:

Chin Seng Rice	No. 1	$330 per coyan
Hock Hoe Rice	No. 2	$320 „ „

Siam Rice	No. 1	$320 per coyan
Siam Rice	No. 2	$290 „ „
Rangoon Rice	No. 1	$205 „ „
Rangoon Rice	No. 2	$195 „ „
Broken Rice		$125 „ „

The average quality of Malay native rice corresponds to that of Rangoon and Broken rice valued at the time at $200 and $125 respectively.

The experiments in Krian have already shown that on the poorer land it is possible by proper cultivation, to increase the yield about five fold, and it is expected that this will be still further increased in subsequent years. Add to this the improvement in the quality of grain and the value of the crop whatever its yield may be, is doubled.

The attainment of this result is dependent on several years of uncertain experimenting the cooperation of the miller, and the education of the native cultivator.

TUBA ROOT.

By W. L. Wood.

Derris elliptica, Benth. (Tuba Root) is a scandent shrub of the order Leguminosae, indigenous to Burma and Malaya. Very little is known of the useful properties of this plant as an insecticide, and the following results of experiments may be of interest.

During the early part of the year the cabbage on Maxwell's Hill was partly destroyed by small caterpillars of about three species which has not yet been determined. The usual emulsion of kerosine and soft soap did very little good, and when sprayed frequently, brought about "Scorch." A solution made from Tuba root was next tried, and after several applications, it was seen that the new leaves appearing were free from holes and the plant temporarily free from the pest. Tuba root is made up in bundles weighing about one and a half katties, and is sold in most markets in the Federated Malay States for forty cents. The strength of the solution used for the cabbage was as follows:—one bundle, first crushed by beating, was added to two gallons of boiling water and a few hours were allowed for soaking. The water then presented a milky appearance. This may be called the stock solution. For spraying, one quart of this was added to two gallons of water, and the whole well churned. Spraying was done usually after sunset. The heavy rains on Maxwell's Hill necessitated frequent usage, and the spray had often to be used again the following morning if rain fell during the night. Unlike the kerosene emul-

sion no scorch was seen after bright sunshine. By persistent sprayings the cabbage can easily be rid of the caterpillar pest with no apparent damage or retarding of growth. A forty cent bundle will make 16 gallons of an effective insecticide, sufficient to spray a quarter of an acre of cabbage.

A further trial was carried out on a bed of germinating celery. About a week after planting the seed, a colony of ants took up their abode in the bed, working channels and mounds and doing much damage. The Tuba Root solution was applied in the same proportions as was used for cabbage; it was poured over by a watering-can and the soil was well saturated. A few hours afterwards not an ant could be seen. It was expected that the seedlings which were just pushing their way through the soil would have suffered by the solution but no apparent damage or retarding of growth was noticed. Although the proportions used were not sufficiently strong to cause death among the ants, the solution appeared to bring about migration.

Tuba root solution compares very favourably with chemically prepared insecticides, since it can be used for spraying the tenderest of leaves and seedlings, and for saturating the soil under standing crops with no apparent damage to either roots or leaves. Its cheapness and effectual properties should make this plant more widely known and used, and to export the solution in a concentrated form would possibly be a profitable business. Its use in English orchards against codling moth and gooseberry maggot would be well worth a trial. Another use to which it may be put is for bathing dogs, using one quart of stock solution to one gallon of water. It readily kills fleas and ticks and does not irritate the skin, excepting in a case where the dog has mange; then on no account should it be used. A short article in letter form appears in Agricultural Bulletin, Volume XI, page 218, signed J. M. Hoover, stating its effectiveness in ridding a small rubber plantation of white ants. The editor in a footnote appears to hold no opinion for or against, and also states he has never seen the plant growing wild except on lime-stone rocks. It must be fairly common in the Federated Malay States as it can be brought in most markets.

Living specimens may be seen growing under rubber trees in the grounds of the Perak State Museum, Taiping, and in the Government Fruit Nursery, Taiping. In both these places it thrives.

In purchasing Tuba roots from the markets it is well to break open the bundle; the interior is often filled with rubbishy fibrous roots and plenty of soil to make weight while the outside is neatly arranged with long and useful looking roots. One more point to observe is the freshness; when old, the strength of the solution is

reduced to a great extent. The name proper is unknown to the Chinese in the markets and often a difficulty is experienced in making them understand what is wanted. The Malay name is Tuba and invariably reaches home.

[The tuba plant is grown by Chinese in vegetable gardens and can be bought in the market at Kuala Lumpur where it has been sold recently in large quantity, It is extensively used by Chinese in vegetable gardens, not only as an insectifuge but also to keep cows and goats from eating the vegetables. The plant provides also the well-known fish poison. Ed.]

THE OCCURRENCE OF BUBBLES IN SHEET RUBBER.

By M. Barrowcliff.

The formation of the small air bubbles that are not infrequently met with in plantation sheet has been variously ascribed (*a*) to the use of too much or too strong acid when coagulating and (*b*) to the employment of too little acid. In endeavouring to decide which of the above somewhat divergent statements more nearly approximated to the truth it fell to the writer's lot to obtain bubbles with every proportion of acid employed, from the minimum possible to the maximum practicable.

The problem, thus appearing to be less simple than it seemed at first sight, was subjected to more extended experiments to define the conditions predisposing to bubble formation, and the conclusions about to be given were arrived at.

The underlying reason for bubbles appearing at all is of course that certain gases, either those of the atmosphere, oxygen and nitrogen, but mainly carbon di-oxide, which are originally dissolved or combined in the latex subsequently become liberated at a time when their free access to the air is prevented, *i.e.*, during or after coagulation, and thus are compelled to remain embedded in the rubber.

To show how this may happen it will be convenient to follow through the various processes of the preparation of rubber and to point out under what conditions at each stage bubble development may occur.

On adding the coagulant to the latex there is usually a brisk effervescence and escape of gas. This is due to the interaction of the acid with bicarbonates of magnesium and calcium which are contained in the latex, the gas evolved being carbon di-oxide. Obviously then if excess of acid is used and coagulation sets in rapidly, part of this gas will be imprisoned and form bubbles, as becomes evident after drying the rubber.

A too rapid coagulation therefore is the first cause, taking them in order, leading to bubble formation.

On the other hand if too little acid is used, bubbles— and in particular "coagulations marks," the pocked appearance caused by bubbles forming and bursting on the under surface of the sheet— will again almost certainly be obtained.

The cause in this case is less obvious, but may be due either to a gradual decomposition of the bicarbonates or to the setting in of putrefactive alterations. That too little acid *is* being used is indicated by an excessive surface darkening and oxidation taking place during and after coagulation.

If on the other hand the employment of more acid effects coagulation too quickly then an unduly diluted latex is probably being dealt with and less water should be added in the field.

However assume that the correct quantity of coagulant has been used and that the mixture has been transferred to the dishes. It is now saturated with carbon di-oxide *at the prevailing atmospheric temperature.* The solubility of this gas in water and in such solutions as that we are dealing with however *decreases* as the temperature rises, any increase in the temperature causing a further portion to be expelled from the solution.

If then, owing perhaps to the factory getting more sun in the afternoon than in the morning, the coagulum gets warmer, this carbon di-oxide will be evolved and must form bubbles in endeavouring to escape.

This is the next point to observe therefore if trouble of the nature under discussion is being experienced, that the temperature of the room in which the dishes are standing should not be higher afterwards than at the time of coagulation. If it does get higher better ventilation is called for.

The safe passage of the sheet to and through the rolling stage must not however, as might perhaps be thought, be the signal for the cessation of vigilance. It still contains up to 35% of the solution, saturated with gas that may yet cause trouble.

If the rolling has been tight, especially if differential rollers have been used, further risk is small as the greater part of the solution will drain out in the course of a few hours, carrying the gas with it. If on the other hand the rubber has been evenly rolled, and not very tightly, the rate of drainage is very slow and a large amount of water will be still remaining when the sheet is placed in the Smoke house.

Whilst in this state any appreciable rise in temperature, such as may be caused by having too large a fire or to the sheet being hung too near to it, will produce a luxuriant crop of bubbles.

This is the last of the list of possibilities, and, as the phenomenon only needs to be clearly understood for the necessary preventive measures to become obvious, it is hoped that these notes will assist in the avoidance of this particular one of the minor defects to which sheet rubber is subject.

As a rule a latex containing approximately 12% of rubber, pure latex diluted with an equal volume of water, will require 2¼ to 2½ oz. of a 5% acetic acid solution per gallon to effect a satisfactory coagulation for sheet rubber.

HOW TO DISTINGUISH DIFFERENT ORDERS OF INSECTS IN THEIR VARIOUS STAGES.

ISOPTERA, CORRODENTIA, MALLOPHAGA, & ODONATA.

By C. B. Holman Hunt.

Before discussing in detail the various insects to be described in this article I wish clearly to point out the difference between an incomplete and a complete metamorphosis.

(i.) Creatures closely resembling the adult in shape and chiefly distinguishable by their small size and their lack of wings; these are known as nymphs and feed and grow until the final instar (or stage,) when they develop wings and become adult.

Insects usually lay eggs. These eggs hatch out into either

(ii.) Creatures differing from the adult in shape and size; these are known as larvae up to the last instar but one, when they undergo a complete change of the internal organs under a chitinous more or less immobile shell are then called pupae, and from these emerge the imagines or perfect insects.

Between the incomplete and complete metamorphoses there are many grades and it is often difficult to decide whether the immature forms differ from the adult in shape sufficiently to rank the metamorphosis as complete; the term "complete metamorphosis" therefore is now used to designate the case where an insect undergoes a resting pupal stage.

Although Termites (or white-ants) have been included in the Introduction to this series of articles among the Neuroptera together with the Psocidae and Book-lice and Mallophaga or Bird-lice, the incompleteness of their metamorphosis has disposed certain American Entomologists to place them in separate orders, and with this view I am inclined to agree. The following then would be the arrangements with the characteristics between the Orthoptera and Neuroptera,

Isoptera: social insects of several distient castes of which only the Kings and Queens possess wings and these soon fall off. The two pairs of wings are long, about equal in size. The mouth-parts are fitted for biting. The metamorphosis is incomplete.

Examples. Termites or White-ants.

Corrodentia. A small order of small insects. When they possess wings, these are membranous, the upper pair being generally larger than the lower with perminent veins and often smoky in hue. These insects possess biting mouth-parts and undergo but a slight metamorphosis.

Examples. Psocidae and book-lice.

Mallophaga. Wingless parasitic insects with biting mouth-parts and an incomplete metamorphosis.

Examples. Bird-lice.

The true Neuroptera undergo a complete metamorphosis, but the Dragonflies are usually included in this group, and in their case, although the nymph is very different from the imago, there is no resting pupal stage, so that they have also been placed in a separate group of their own, the *Odonata.*

The Neuroptera then, as defined in the Cambridge Natural History, may be divided into the following groups on the American and more modern systems.

Isoptera.
Corrodentia.
Mallophaga.
Odonata.
} Incomplete Metamorphosis.

True Neuroptera. Complete Metamorphosis.

The true Neuroptera are represented by the Lace-wing Flies and the Ant-lions, and not by the White-ants and Dragonflies as given in the introduction.

The Isoptera include, as mentioned before, the Termites (wrongly called White ants as they are only resemble true ants in their social habit).

Termites are somewhat akin to the Orthoptera.

They do useful work in the jungle in breaking up dead trees, but in houses and on cultivated land in the Tropics they are perhaps one of the most serious insect pests that have to be dealt with. Their mode of working is to eat out the inside of any object that they attack, whether it be the sole of a boot, the beams of a house, the contents of a wooden box or the heart of a tree. Where they have to advance to their attack over an open space, they carefully build a tunnel of clay to cover their approach.

They are divided into a number of groups, but with these we need not deal here, as they have been fully treated in De Haviland's book, and there are only three species which need special attention

here. They are Termes malayanus, gestroi and carbonarius, and the soldiers of these have all been fully described in Mr. Pratt's Bulletins Nos. 1 and 3.

De Havilland's system of separating the species in the soldier stage is very useful, but when several species inhabit the same nest, as is often the case, it is difficult to identify the other castes, and I propose therefore to give a life and social history of Termites in general and then the characteristics of the workers, Kings and Queens of the three species mentioned above. But it must be remembered that not all Termites have quite the same habits, and that this is a general account and not a monograph of the group.

The constitution of the individuals in a nest is as follows.

I. Eggs.
II. Immature Individuals of each of the castes below.
III. Workers. } Sexually immature males and females.
IV. Soldiers. }
V. Sexually mature males. } Winged.
VI. Sexually mature females. }

All start from an egg. It is questionable whether the different castes arise from different kinds of eggs or become different owing to special variations of food, but the eggs from a single pair do, as has been found by experiment in India, give rise to individuals differentiated into workers and soldiers, but these can be changed at will by the colony into sexually mature males or females.

It has however been noted that when the nymphs first emerge from the egg they are all alike, but after the first moult there are found to be two types of individuals:

(I) small-headed, which give rise to castes Nos. V and VI.
(II) large-headed, which grow into workers and soldiers.

There are usually two forms of soldiers characterised by differences in size, and in the shape of the head.

The soldiers are fed by the workers on chewed food, as they are incapable of masticating grass or wood themselves.

The immature of castes Nos. V and VI possess at an early age, after the second moult, the thoracic pads which give rise to the wings.

The soldiers are blind, and attack with their sharp jaws any strange object that may be placed in their way. In the case of T. carbonarius they bump their heads rhythmically on the hollow floors of the nest when that is being demolished, and the noise resembles the rustling of a snake inside which no doubt acts as a deterrent to some animals that try to break in.

Most of the Termites make cultures of fungi (or mushrooms and moulds) on which the young are fed.

The Queen cell is generally low down near the centre of the nest, and in it she continually lays eggs which are carried off by the workers to the nurseries.

Further details may be obtained from Mr. Bainbridge Fletcher's Indian Bulletin entitled "Termites."

The following are the measurements and distinctive characteristics of Termes malayanus, gestroi and carbonarius throughout castes III, IV, V, and VI, according to De Havilland.

Malayanus.

Caste III. Mature worker, $\frac{1}{5}$ inch long, head 2/25 broad.
Antennae 18 joints.

Caste IV. Mature soldier (larger), $\frac{2}{5}$ inch long, head 3/25 inch broad.
Antennae 17 joints.

Caste V. Mature male, $\frac{3}{5}$ inch long.
Antennae 19 joints.

Caste VI. Mature female, 1 inch long, head 7/25 broad.

Gestroi.

Caste III. Mature worker, $\frac{1}{5}$ inch long.
Antennae 15 to 16 segments.

Caste IV. Mature soldier, $\frac{1}{5}$ inch long, head 1/19 broad.
Antennae 14 to 16 segments.

Caste V. Mature male, 7/25 inch long.
Antennae 19 segments.
Anterior wing stumps much larger than posterior, wings very hairy.

Caste VI. Mature female.

Carbonarius.

Caste III. Mature worker, 8/25 inch long, head up to 1/11 inch broad.
Antennae 18 segments.

Caste IV. Mature soldier (larger), 16/25 long, head 9/50 broad.
Antennae 17 segments.

Caste V. Mature male, 18/25 long, wing 1 inch long.
Antennae 19 segments.

Caste VI. Mature female, 18/25 long, wing 1 inch long.
Antennae 19 segments.

The lengths of Caste VI. do not include that of the egg-laying Queen.

The Universal White Ant Destroyer is still considered one of the best remedies for all these tunnelling pests but in the case of living trees it is better not to place the nozzle in such a position that the hot fumes can scorch the tender bark.

INTERNATIONAL ASSOCIATION OF TROPICAL AGRICULTURE AND COLONIAL DEVELOPMENT.

Formation of a British Section.

The International Association of Tropical Agriculture and Colonial Development was founded at the close of the first International Congress of Tropical Agriculture held in Paris in 1905.

The object of the Association is the promotion of the scientific and practical study of all questions connected with tropical agriculture and the development and utilisation of the natural resources of the Colonies. The President of the Association is Professor Wyndham Dunstan, L.L.D., F.R.S., Director of the Imperial Institute, who was elected at the close of the International Congress held in Brussels in May, 1910. The Association has its headquarters in Paris and is governed by an International Board, from which an Executive Committee of from five to seven administrators is selected.

The work of the Association is to promote investigations into questions of special importance to tropical agriculture, to publish the results of these enquiries, and to organise International Congresses for the discussion of the problems of Tropical Agriculture and Colonial Development. Two Congresses have been held already and it is proposed to hold the third Congress in London in 1914.

A British Section of the International Association has now been formed, which will be responsible for the organisation of the Congress in London.

The work of the Association is not only of interests to Departments of Agriculture and Forestry but also to planters and to merchants and manufacturers who are concerned with tropical and colonial raw materials, and it is hoped that all those interested in these important subjects throughout the Empire will join the British Section of the International Association.

The annual subscription for members of the British Section of the International Association is one pound, payable on the 1st January in each year.

Members of the British Section will have the priviledge of taking part in the London Congress without further special payment. They will also receive all the publications of the International Association. In addition, the quarterly "Bulletin of the Imperial Institute" will be issued to them free of charge. A reading and writing room will be reserved at the Imperial Institute for the use of members of the section when in London, and members will also be entitled to make use of the General Library and Reading-rooms of the Imperial Institute.

Subscriptions may be paid by crossed cheque or money order, payable to the Secretary, International Association of Tropical Agriculture and Colonial Development, British Section, and, in the case of money orders, should be drawn on the General Post Office, London.

Letters and subscriptions should be addressed to "The Secretary, British Section, International Association of Tropical Agriculture and Colonial Development, Imperial Institute London, S.W."

NOTES ON THE SINGAPORE MARKET FOR STRAITS PRODUCE DURING OCTOBER, 1912.

In consequence of the political situation in Europe, business in the principal consuming markets has been much restricted, and prices generally are a good deal lower.

Peppers. Singapore Black after improving slightly has gradually declined, and closes weak at $20. Transactions have been small, and supplies of inferior quality. The crop of Sarawak White is coming to an end, and the price has declined to $33. Pulo Laut, Sambas, and Singkawang Peppers have been arriving in fair quantities, and have been bought at $34.35 according to quality.

Gambier. Arrivals have been large, and in the absence of demand from Europe the price has declined to $8.30 with every prospect of going lower still. Cube Gambier is also easier, at $14¼ for No. 1 and $12¼ for No. 2.

Copra. Speculators were short for October shipment, and prices were in consequence well maintained until the end of the month, when a sharp decline took place, our market closing weak at the following prices: Good S.D. $10.85, Bally $10.80, Kayong $10.65, Pulo $10.55, Siantan $10.40.

Rubber. Has declined in sympathy with home markets and closing values are:—

Pale Crepe	...	$215 per picul
No 2 Crepe	...	$198 ,, ,,
Smoked Sheet	...	$219 ,, ,,
Unsmoked Sheet	...	$215 ,, ,,
Scrap	...	$160/130 ,, ,,

Quantities offered at the local Auctions are gradually increasing and Estates seem to be slowly realising the fact that with present state of markets, prices current here shew better results than those obtained at public Sales in London.

Tapioca. The market here in this article is now unimportant only small quantities arriving for sale.

Prices are considerably lower and we quote at the close, Small Flake $7.80 and Medium Pearl $6.5/8 for Fair qualities.

Nutmegs. Advanced during the month on speculative buying by some godowns here but prices have since declined again and market closes weaker at $33 for both counts *i.e.* 110*s* and 80*s*.

Sago Flour. Has fluctuated considerably during the month sales having been made up to $4.10. Closing values are $3.90/3.95 according to quality and market looks like going lower. Supplies are about normal.

FEDERATED MALAY STATES.

Comparative Statement of Cultivated Rubber Exported during the Years 1912 and 1911.

Produced in	Exported during Sept. 1912.	Previously.	Total export during the year.	Export during similar period of previous year.	Increase.
	lbs.	lbs.	lbs.	lbs.	lbs.
Perak	842,365	6,466,554	7,308,919	3,757,612	3,551,307
Selangor	1,558,935	11,460,387	13,019,322	7,019,158	6,000,164
Negri Sembilan	550,452	3,741,279	4,291,731	2,468,079	1,823,652
Pahang	16,369	65,441	81,810	15,448	66,362
Total ...	2,968,121	21,733,661	24,701,782	13,260,297	11,441,485

Exported viâ	To United Kingdom.		To Continent of Europe.		To Ceylon.		To America.		Total.	
	Sept.	To date.	Sept.	To date.	Sept.	To date.	Sept.	To date.	Sept.	To date
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
Port Swettenham	1,381,844	12,374,623	184,979	1,678,834	59,823	638,914	...	23,413	1,626,646	14,715,784

Note:— To Australia and Japan nil.

KUALA LUMPUR,
11th October, 1912.

E. S. HOSE,
Acting Commissioner of Trade and Customs, F.M.S.

F. M. S.

Abstract of Meteorological Readings in the various Districts of the States of F. M. S. for the Month of August, 1912.

DISTRICT.	Mean Barometrical Pressure at 32° Fah.	Maximum in Sun.	TEMPERATURE.				HYGROMETER.				Prevailing Direction of Winds.	Total Rainfall.	Greatest Rainfall during 24 hours.
			Mean Dry Bulb.	Maximum.	Minimum.	Range.	Mean Wet Bulb.	Vapour Tension.	Dew Point.	Humidity.			
Kelantan, Khota Bharu	...	139.12	86.49	87.80	74.93	12 87	78.80	.812	72.93	84.5%	...	3.76	1.25
Malacca, Durian Damar Hos.	29.862	149.3	81.9	87.7	72.3	15.4	79	.951	...	88.	N	8.59	2.21 on 19th
N. Sembilan, Dist. Hospital Seremban	...	148.1	80.0	87.3	71.4	15.9	76.3	.839	73.9	82.	N. W.	6.05	0.88
,, Dist. Hos. K. Pilah	...	...	81.1	90.0	71.9	18.1	77.1	.848	74.2	79.	...	1.52	0.70
,, ,, Tampin	...	151.4	80.5	86.6	73.5	13.1	77.3	.879	75.2	83.	...	5.08	1.32
,, ,, P. Dickson	...	154.5	81.2	86.9	74.3	12.6	77.3	.862	74.7	80.	..	10.63	2.05
Pahang, ,, K. Lipis	...	...	80.8	89.4	67.6	21.8	74.4	...	...	...	...	4.87	2.03
Penang, ,, Penang	29.804	153.	82.7	91.5	72.	19.5	77.4	.868	73.8	78.2	...	18.56	6.61
Perak, ,, Taiping	...	106.	82.54	94.	71.	23.	77.35	.870	...	79	...	8 05	3.70
,, Ipoh	...	...	81.97	93.	69.	24.	76.35	.833	...	77	...	4.73	1.39
,, T. Anson	...	...	81.86	93.	70.	23.	77.31	.877	...	81	...	3.81	1 38
,, ,, P. Buntar	...	...	82.54	92.	71.	21.	76 99	.852	...	77	...	13.16	6.03
The Cottage	...	...	...	..	...	...	...	...	...	...	...	23.31	6.70
Selangor, General Hospital Kuala Lumpur	29.868	140.1	80.8	90.	72.6	17.4	76.7	.836	73.9	79	...	2.60	0.3 9
,, Dist. Hos. Klang	...	...	...	88.6	71.0	17.6	...	...	...	...	...	4.37	1.95
,, ,, K. Selangor	...	...	...	88.5	70.3	18.2	...	...	...	...	...	2.97	0.95
,, ,, Rawang	...	...	...	91.2	72.1	18.8	...	...	...	...	...	7.56	1.38
Singapore, Kandang Kerbau													

Abstract of Meteorological Readings in the various Districts of the States of F. M. S. for the Month of September, 1912.

DISTRICT.	Mean Barometrical Pressure at 32° Fah.	Maximum in Sun.	TEMPERATURE.				HYGROMETER.				Prevailing Direction of Winds.	Total Rainfall.	Greatest Rainfall during 24 hours.
			Mean Dry Bulb.	Maximum.	Minimum.	Range.	Mean Wet Bulb.	Vapour Tension.	Dew Point.	Humidity.			
Kelantan, Kota Bharu		146.46	82.3	88.3	74.46	13 83	78.7	.927	77.0	84.8%		8.82	1.69
Malacca, Durian Daun Hos.	29.863	148.9	81.9	87.6	72.5	15 1	78.8	.945	...	87.	N. W.	5.34	1.42
N. Sembilan, Dist. Hospital Seremban	...	149.0	79.9	88.0	71.6	16.4	75.9	.821	73.8	82.	N. W.	7.67	1.80
„ Dist. Hos. K. Pilah	...	118.6	81.2	90.6	71.8	18.8	76.6	.833	73.6	79.	...	6.83	1.36
„ „ Tampin	...	154.6	80.0	86.2	73.4	12.8	76.8	.862	74.5	83.	...	4.22	1.40
„ „ P. Dickson	...	155.9	81.4	87 2	74.5	12.7	76.0	.850	74.3	79.	...	7.51	1.81
Pahang, „ K. Lipis	...	...	81 0	90.6	68.2	22.4	75.1	...	...	...	...	6.24	0.90
Penang, „ Penang	29.821	155.0	81.6	91.5	71.0	20 5	77.1	.870	74.	81.3	...	14.72	2.23
Perak, „ Taiping	...	106.	81.99	94.	71.	23.	76.72	.850	...	78.	...	12.28	3.62
„ „ Ipoh	...	...	81.52	95.	70.	25.	75.98	.822	...	76.	...	2.55	.72
„ „ T. Anson	...	...	81 94	93.	70.	23.	77.25	.873	...	81.	...	3.46	1.61
„ „ P. Buntar	...	...	81.54	91.	71.	20.	76.48	.843	...	78.	...	11.19	2.04
„ The Cottage	...	...	...	. .	...	...	...	...	...	...	...	16.59	2.90
Selangor, District Hospital Kuala Lumpur	...	139.6	81.8	90.5	73.1	17.4	77.2	.849	74.2	78.	...	3.35	0.65
„ Dist. Hos. Klang	..	...	...	88.6	64.5	24 1	...	...	...	...	...	8.58	2.41
„ „ K. Selangor	...	...	...	89.0	70.2	18.8	...	...	...	...	...	3.46	0.90
„ „ Rawaug	...	...	...	91.0	72.0	19.0	...	...	...	...	...	6.59	0.92
Singapore, Kandang Kerbau Observatory	29.875	153.4	81.7	91.4	72.0	19.4	78.8	.895	...	80.	S. E.	6.70	2.82